
Connecting Each to All: Principles to Implement the Goal of Advanced Universal Service

Introduction

The Alliance for Public Technology (APT) is a coalition of individuals and more than ninety nonprofit groups. We believe that our nation cannot reap the full benefits from advances in telecommunications technology unless everyone has full access to a network that is capable of providing informational and transactional services using voice, high speed data, graphics and two-way video.

This document sets forth the principles which are essential to guide the implementation of an advanced universal service goal. It is a companion to the 1993 APT paper entitled, "Connecting Each to All: A Telecommunications Platform for the Information Age," which articulated APT's vision of universal service.

APT believes that as our nation moves toward an advanced information infrastructure, guiding principles will be necessary to achieve the goal of advanced universal service.

Alliance for Public Technology

Connecting Each to All: Principles to Implement the Goal of Advanced Universal Service

I. Goal: “Advanced Universal Service”

To make available as far as possible, to all people of the United States, regardless of race, color, national origin, income, residence in rural or urban area, or disability, high capacity two-way communications networks capable of enabling users to originate and receive affordable and accessible high quality, voice, data, graphics, video and other types of telecommunications services.

II. Principles: “A Public/Private Investment Strategy”

1. Transitional policies are necessary, but they must be treated as incremental and clearly linked to the permanent policies designed to achieve the goal.
2. Universal network deployment, interoperability and reliability are fundamental to achieving universal service.
3. A federal commitment to an advanced Universal Service goal must give a clear mandate to state and local governments to develop even-handed incentives for competitors to aggregate effective demand for community-based applications (i.e. education, health care, labor market operations, and the needs of the disability community).
4. Competition should be relied upon where it furthers the goal of advanced universal service and promotes citizen use of these new technologies.
5. We must create a fair regulatory environment as soon as possible that treats similar providers similarly, and responds quickly to changes in technology and the organization of industries.
6. Develop multi-level public/private partnerships among governmental agencies, community organizations and nonprofit and industry groups to create and implement telecommunications policy.
7. Recognize the importance of non-regulatory roles for governments at all levels (i.e. delivery of government services, contracting power, etc.).
8. Develop privacy, copyright and consumer protection safeguards and ensure training and demonstration projects for citizens and nonprofit organizations.

Connecting Each to All:

Principles to Implement the Goal of Advanced Universal Service A Public/Private Investment Strategy

I. Goal: Advanced Universal Service

“To make available as far as possible, to all people of the United States, regardless of race, color, national origin, income, residence in rural or urban area, or disability, high capacity two-way communications networks capable of enabling users to originate and receive affordable and accessible high quality, voice, data, graphics, video and other types of telecommunications services.”

Why this goal?

Until now, the term “universal service” has been associated with making voice telephone service ubiquitous in a rapidly fading monopoly environment. In the emerging competitive environment of multi-media, multi-vendor, and fully inter-active communications, that narrow term and its regulatory baggage should give way to a new notion of “advanced universal service” that embraces a vastly expanded approach. By focusing on network capabilities, rather than specific technologies, APT’s definition creates a new approach to universal service for the 21st century that recasts and restores the relevance of the concept advanced by the Communications Act of 1934 for the 20th century.

APT has adopted this goal because it is a natural evolution of the historic national communications policy of this country. Starting with the postal service and its rural free delivery and the precedent of the 1934 Communications Act, our nation’s policies have encouraged communications services to the public. These policies are premised on the recognition that communication services are critical to the viability of our democratic society. APT’s policy is also premised on the recognition that communication services are the glue that binds a democratic society together. This view is particularly applicable to modern communications networks which will dramatically affect the way citizens work, learn, participate in their government and access health care and other services. These networks can provide important and diverse benefits which include reduced cost and increased convenience and quality of important public services ranging from in-home health care to education and job training. Specific benefits include access to jobs for people now isolated from the economic mainstream; enhanced opportunities for participation in democratic decision making; increased social and economic opportunities for people with limited mobility; and greater opportunities to form ties with other people who have common interests and concerns. Societal benefits will only increase as more and more people are connected to the network for in-home delivery of health care, lifelong learning and parent/school involvement in programs such as home work assistance, help with English as a second language, access to government officials, and other similar services.

Achieving this goal presents a dilemma: people cannot receive these services if they cannot hook up to or afford and use the new wireline and wireless technologies necessary to deliver these services. The public will not demand that the new networks be installed if they do not know about or value the potential services that these advanced networks are capable of delivering. APT believes that a successful policy must comprise a two-pronged approach that addresses both the capabilities of the new networks and the creation of socially valuable services, especially those of a governmental nature, that should be available as soon as possible after the networks come on line.

Implicit in our functionality based approach to universal access to the new telecommunications technologies is the principle that we must build upon what we have achieved to date in pursuit of universal voice grade telephone service.

II. Principles:

The universal access goal outlined above will be achieved by carefully orchestrating policies and plans developed by entities in both the public and private sectors. Here we outline eight principles, all of which will be needed in order to facilitate the accomplishment of national public policy goals and lead us to the goal of advanced universal service.

1. Transitional policies are necessary but they must be treated as incremental, and clearly linked to the permanent policies designed to achieve the goal.

The transition to universal service will not be easy. We must ensure that people do not have to give up basic telephone service because the cost of infrastructure modernization, in a competitive environment, pushes cost based pricing to an unaffordable level. What we know today as universal service, (primarily voice-grade service), must be sustained in the transition to a broader concept of universal service and upgraded periodically as new ubiquity goals of our society evolve and become definable by advanced telecommunications service and products.

Transition policies must offer regulators flexibility to respond to changing conditions, always keeping the final goal of advanced universal service in mind. They must always be consistent with an approach to advanced universal service in the information age that is defined in functional terms rather than specific technologies.

A "safety net" fund in a market driven system is essential to achieving universal advanced service provided in a competitively neutral fashion and in a manner consistent with essential policy goals.

2. Universal network deployment, interoperability and reliability are fundamental to achieving universal service.

In order to reach our goal of universal service, public policy objectives must always strive to broaden the base of effective demand that drives private investments in the development and deployment of advanced networks.

It will be especially critical to ensure network deployment in underserved areas. Given the skewed population density and income distribution in the society, the “demand pull” that evolves out of the normal operations of markets may not be sufficient to achieve either the societal goals of universal service or the commercial requirements of ubiquity in our telecommunications networks. Public policy must focus on ensuring that the savings derived from the network productivity increases which result from modernization are captured to deploy the technology in these areas.

Where operating efficiencies are achieved through investments in advanced network technologies, public policy should give special attention to how those efficiencies are captured and deployed in the process of network modernization. High standards of connectivity, inter-operability and reliability are essential requirements of private networks which are to function as public infrastructure in a competitive environment. Public policy should also be focusing on how savings derived from network productivity increases may be used to advance network ubiquity and universal service goals.

By their very nature, operational savings derived from the modernization of public telecommunications infrastructure, while stemming from investments made in a competitive environment, retain a quasi-public quality. As they are plowed back into network development and deployment, they must be invested with a strong sense of public responsibility, consistent with achieving social and community goals. Current policies which impute productivity increases in price-cap regulation, therefore, need to be examined carefully to make sure they are compatible with advancing universal network deployment and developing applications of advanced technology that reach a broad spectrum of the society.

3. A federal commitment to an advanced universal service goal must give a clear mandate to state and local governments to develop even-handed incentives for competitors to aggregate demand for community-based applications of advanced telecommunications technology (i.e. education, health care, labor market operations, and the needs of the disability community).

The migration of voice-grade services to a fully interactive multimedia concept of universal service requires focus on developing community-based applications of new technologies. These applications can aggregate demand for advanced telecommunications and thus become significant drivers of private investment in developing and deploying the nation's public telecommunications infrastructure.

Even though development of community based applications are essential to market building, the telecommunications industry cannot be expected to assume the full burden of funding these applications. Aggregating demand requires that telecommunications policies be integrated with other public policies that can provide the basic financing for such applications. Public policy in telecommunications must recognize that it is in the interest of both competitors and the public to work cooperatively with local governmental agencies and under-funded community organizations to develop "interfacing" required for aggregating demand for community based applications. As the applications of new communication technologies are developed, they need to be integrated into the budgets of schools, libraries, health care systems, labor market operations and a wide variety of government services.

4. Competition should be relied upon where it furthers the goal of advanced universal service, and promotes citizen use of these new technologies.

A competitive model for all telecommunications services is the nation's best assurance that interactive, multi-media communications products and services will be expeditiously and efficiently developed and marketed. However, there is no assurance that the evolving environment for telecommunications will be fully competitive or that markets which are dominated by only a few competitors will necessarily allocate resources in a manner that addresses social needs and community priorities. Where competition evolves out of prior regulated-monopoly areas of service, special attention needs to be given to tendencies toward concentrations of market power. In pursuit of a competitive environment, for example, economies of scale and scope which are associated with market power should not be thrown to the wind. Where concentrations of market power persist in the face of the nation's commitment to competition, policies designed to promote competitive entry should be coupled with policies aimed at preventing economies of scale and scope from being dissipated by "niche" market competitors or others without assuming some responsibility for advancing network ubiquity and universal service goals.

Public policy makers must recognize that markets which are dominated by only a few competitors will not necessarily allocate resources in a manner that addresses social needs and community priorities. There will be areas, therefore, where regulation and oversight are essential to achieving the broader advanced universal goal of the information age. Local communities are already indicating a strong interest in how competitive network development and deployment address their community goals and priorities.

Specifically, where network investments fall short of achieving the infrastructure requirements of a diverse population, the focus of regulatory policy should be on how those requirements can be fulfilled to meet the needs of all citizens in society. Where regulatory intervention is necessary, our commitment to a competitive model requires that where possible such intervention be incentive-oriented.

The types of regulatory policies required are discussed in Principle 5.

5. We must create a fair regulatory environment as soon as possible that treats similar providers similarly, and responds quickly to changes in technology and the organization of industries.

Where regulation is necessary, it must be equitable and feasible and advance public policy. The goal over time must be that all telecommunications providers offering switched service, for example, be treated similarly. Regulation must minimize command and control and focus on creating incentives.

In developing even handed incentive regulation, market realities must be confronted. Market building investments in areas of social and community value may have longer turn-around periods than investments in other areas. Thus regulatory incentives and other public policies must be aimed at overcoming these market disincentives to long run market building and at facilitating applications of technologies which are "at risk" of being given secondary attention in the normal operations of markets. It must also focus on how network savings in productivity increase might be captured to deploy telecommunications technology to achieve social and community goals.

Other areas where regulation will be needed to ensure the kind of networks and services we envision are:

- Common carriage so that individual citizens can send as well as receive messages;
- Interconnection and interoperability;
- Security and reliability;
- Privacy;
- Consumer protection from fraud;
- Universal design so that hardware, software, and equipment are usable by anyone, regardless of disability; and
- Mechanisms to ease the cost and inconvenience of technology obsolescence for consumers.

6. Develop multi-level public/private partnerships among governmental agencies, community organizations and nonprofit and industry groups to create and implement telecommunications policy.

The federal role is to set the overall goal and take actions that would otherwise have to be taken 50 separate times, and to preempt the states and localities only in areas where it is clear that there should be no regulation (e.g. rates for CPE or information services). The FCC should steer the process of introducing full and effective competition and overall deregulation, with the states largely doing the heavy rowing to implement it.

The states act to implement specific areas of open entry - full competition process, such as developing specific regulatory incentives, effective interconnection and unbundling, proper pricing signals, pushing the evolving universal service concept. Localities must be involved in deciding policies for fair, equitable use of their rights-of-way. They should not become a third layer of telecommunications regulation, but they have a significant role to play

when the implementation of federal and state policies is dependent upon the cooperation of local communities. All levels must work together on developing electronic service delivery mechanisms.

Inter-governmental and public/private partnerships should be encouraged to aggregate demand so that competitors can understand the potential for profitable service in locations that do not seem profitable. Developing and facilitating applications of the evolving technologies in such areas as education, health care and governmental information are socially necessary as well as critical to achieving almost any promised vision of the information age. Yet, it is in these community-based applications that the development and aggregation of effective demand may be most difficult to link up with the investment decisions of industry competitors unless the various parties have developed working relationships with each other and have participated in pilot programs demonstrating community use of these new technologies.

7. Recognize the importance of non-regulatory roles for governments at all levels (i.e. delivery of government services, contracting power, etc.)

Governments are significant users and providers of advanced telecommunications networks and services. As a result, they are in a strong position to influence the development of these networks. Moreover, states understand the importance of these networks to their goals of economic development, health care access and cost containment and improvement of education and these departments can influence the development of these networks in their states through their budget allocations.

Among the proactive steps governments can take that do not entail regulation are to:

- Provide leadership in educating the public on critical needs and opportunities.
- Commit to deliver services electronically, in order to create demand for public services in a market environment. In the transition period to advanced universal service, offer these services both electronically and in traditional media.
- Offer incentives to the private sector to deploy and invest in advanced networks for underserved areas so that services can be delivered equitably.
- Provide support for research, evaluation and demonstration projects, and disseminate findings to policymakers and to the general public.
- Offer incentives to individuals to act electronically (i.e., save money by transacting business with the government on-line).

8. Develop privacy, copyright and consumer protection safeguards and ensure training and demonstration projects for citizens and nonprofit organizations.

Citizens' concerns for privacy may create significant barriers to their use of advanced networks. E-mail communications, the delivery of personally identifiable health care information and services and citizens' usage patterns of the enormous variety of services that are delivered electronically are highly vulnerable to invasions of their privacy. A comprehensive privacy statute dealing with telecommunications and with health care

information are essential if citizens are to be able to use these advanced networks without risking fundamental rights.

Unless copyright issues in the electronic media can continue to maintain the delicate balance achieved in the print media between fair use and protection for the rights of authors and artists, the new electronic technologies may discourage rather than promote the free flow of information so vital to the functioning of our democratic system. Legislation embracing the fair use doctrine in electronic media is essential.

Finally, adoption of any new technology frequently meets with resistance from individuals who are not familiar with the benefits which these technologies can provide. In order to overcome this resistance, it is essential that citizens and non profit organizations have the opportunity to learn how to use the new communications technologies in real time on line demonstration projects.

Conclusion

By using these eight principles to guide telecommunications policy development, the Alliance for Public Technology believes that our goal of a functionality defined advanced universal service is attainable.

Acknowledgments

The Alliance for Public Technology dedicates this paper to the memory of Dr. Susan G. Hadden, who was a member of the APT Board and Chair of its Public Policy Committee at the time of her death in January 1995. One of her last writings was an early draft of this statement of principles.

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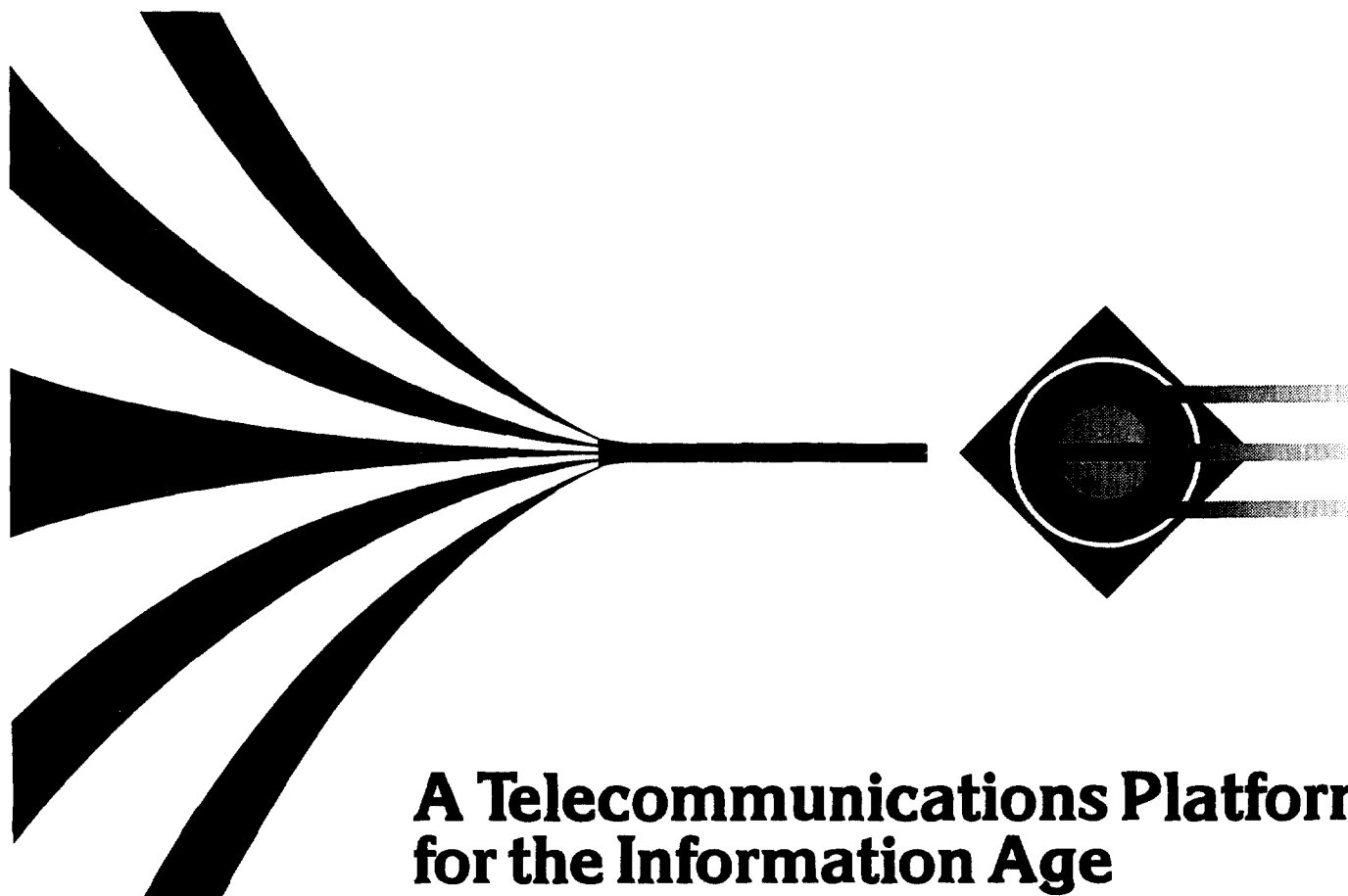
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Connecting Each to All



**A Telecommunications Platform
for the Information Age**

Connecting Each to All: A Telecommunications Platform for the Information Age

Introduction

The Alliance for Public Technology (APT) is a coalition of individuals and more than forty nonprofit groups with thousands of members. We believe that our nation cannot reap the full benefits from advances in telecommunications technology unless everyone has full access to a switched broadband network that provides information and services as well as entertainment. The more people on the network, the greater the demand for innovative services that can be marketed both here and abroad. Economies of scope can benefit all citizens, regardless of race, age, economic status, functional limitation or location. By connecting each one to all the others, we strengthen the fabric of society. At the same time, we promote economic development and help people to strengthen their individual identities.

This document updates and expands a 1990 APT paper entitled, "An Information Age Agenda: The Telecommunications Services Platform." Since 1990, telecommunications technology and policy have changed considerably. The cost of fiber optic cable, a central component of modern networks, has dropped to almost that of copper cable. Rapid advances in applications software, miniaturization, signal processing, video compression, mobile communication, and other telecommunications capabilities, such as fiber rings in major cities, as well as the new broadband transmission services provided by cable television operators have brought some aspects of our vision closer to reality and have made new opportunities possible.

At the same time, the Federal Communications Commission (FCC) has taken steps to reduce federal regulation in the telecommunications arena, including opening up more of

the telecommunications transmission spectrum to the private sector, reducing restrictions on ownership of radio and television stations in a single market, and authorizing Bell Operating Companies to offer video dialtone. The National Telecommunications and Information Administration (NTIA) has released a major report on U.S. telecommunications infrastructure, emphasizing its importance to today's economic, social, and political landscape and calling for more deregulation of telecommunications markets. The federal courts have lifted the restriction that prevented the Bell Operating Companies from providing information services. Congress has passed a law to set up the powerful National Research and Education Network (NREN), and it has overridden President Bush's veto of legislation regulating cable television.

APT's updated vision still focuses on the need for a "telecommunications platform" that provides universal access to a wide variety of information services. The types of services that should be supported, however, are no longer limited to "narrowband" voice and data. Two-way interactive multi-media applications (including integrated voice, data, and video) are proving successful in trials across the nation. It is time to begin considering how these opportunities will be made available to everyone who needs and wants them. We therefore call for upgrading the public telephone network to a *Broadband Telecommunications Platform* that supports two-way interactive multi-media applications. Other nations are already on the way to this goal. Japan, for example, has launched an extremely ambitious fiber-to-the-home program that could make it the world's telecommunications leader by the early part of the 21st Century.

Information is the currency of democracy. APT believes it is the essential component in strengthening the domestic economy and increasing equality of opportunity in the Information Age. APT supports public policies that will speed the day when everyone has access to a *Broadband Telecommunications Platform* and the informative and entertaining services it would be able to support. Universal access to the network and its services will:

- Empower individuals to obtain information and entertainment when they want it and in a form useful to them.
- Empower information providers, who will be able to offer diverse innovative services to everyone on the network.
- Empower our nation, making it competitive in global markets against nations that have already adopted policies leading to national broadband networks.

Today

Jim has just left the military as part of the downsizing. He and Ulrika, his foreign-born wife, return to his hometown, only to find that the local factories are not hiring. Subsequently, Jim takes a job as a short-order cook. Enrolled in the local public school, his children find themselves behind in some subjects and ahead in others, reflecting the different emphasis of their overseas education. The teacher also notes some behavioral adjustments and would like to meet with the parents, but Jim cannot leave his new job to meet with her, and Ulrika's English is not adequate for a parent-teacher conference. Jim and Ulrika, unable to make a start in their chosen home and worried about their children, move to the nearest large city where each take jobs as grocery clerks.

Tomorrow

A few weeks before Jim's demobilization, he starts his job search on the universal telecommunications device in his home on the overseas military base. He enters his preference for living in his old hometown and lists the skills he has acquired during his military stint. The job locator service identifies a job in the right area, but it is not one of the old factory jobs he expected. Instead, it is a job in a new credit card processing center that has located in his rural area where housing is cheap and the necessary telecommunications are available. Unfortunately, the job requires certification in repair of certain electronic components—certification that Jim lacks. He immediately enrolls in a job training program, getting lessons over his universal telecommunications device. He takes practice tests, reviewing portions he does not understand with a live tutor he can see and talk to from thousands of miles away. Finally, he takes the "written" portion of the certification exam. He gets the job and he and his family move.

Ulrika, Jim's wife, whose native language is not English, studies at home while the children are in school. The kids, finding that they are well ahead in math because of their European educations, are able to study advanced math taught by a teacher in the large city fifty miles away. They work to overcome their relative disadvantage in English literature by taking an electronic tutorial during study halls when they have time. Worried about the children's reluctance to participate in the less structured school activities, the teacher arranges a video conference with Jim and Ulrika during the school day, "meeting" him at his job and her at home. All three agree to work together to speed the adjustment to the new school and friends.

Today

Ann and Jim are struggling to find an attractive living situation for Jim's father, Walter, who is 78. Walter adamantly refuses to consider moving into a nursing home, but a few recent mishaps in Walter's apartment have convinced Ann and Jim that Walter needs closer care. Ann, Jim, and Walter talk about the choices. Ann and Jim talk to their friends about this problem and vow that they will start attending the local "Eldercare Options" meetings held once a month at the community center, but they find it difficult to make the evening meetings. They compile an informal list of retirement communities and nursing homes, relying on friends and information sent by their local social service agency. Then they call each home, asking about location, services, and prices. They struggle with "telephone tag" and a few hard-sell sales representatives, and finally compile a list of four places that seem to meet Walter's needs. They juggle their schedules to set up visits. Meanwhile, Walter talks with some friends in his apartment building who steel his resolve about not going into a nursing home by telling him horror stories of regimented schedules, nosy nurses, and exorbitant prices. When Ann and Jim tell Walter about their visits, he is furious, accusing them of trying to "bury me before I'm dead." Ann and Jim leave, feeling both frustrated and guilty.

Tomorrow

After Ann and Jim have talked with Walter about his situation, Jim goes to his study and turns on his terminal device—a TV screen with a little camera attached. Browsing the index of services, he finds three sources of information about housing opportunities for older citizens. One, supported by a senior citizens' community center, includes maps of locations, lists of services, and current prices and availability. There are even videos for several of the institutions, which provide a "walking tour" through their facilities. Curious, Jim looks at several videos. He forwards the information and videos about two of the institutions to Walter's video-mail account so that he can look at them later. In his apartment, Walter logs on and retrieves Jim's message. He learns that one center is a member of a network of eldercare centers that hold nightly "video meetings" on topics from fishing to financial planning; residents can attend from their rooms or with others in the center's video conferencing room. Walter joins one of the center's computer conferences as a guest. He is surprised to find that the participants talk about a wide range of topics, and they don't look or sound "old." Walter "meets" with the directors of two of the centers on screen. He finds out that both centers offer in-home care services; and that their health-monitoring facilities are connected directly to a local hospital. Walter also gets information about how to pay for home care and asks the centers to send him additional information on both topics. He also consults an on-line independent health costs information service. When Ann, Jim and Walter get together again, Walter explains the cost-saving alternative of home health-monitoring and home care services, and all agree that a move to a center offering home health monitoring services is best.

The Alliance Vision: Universal Broadband Services

The “tomorrow” scenarios on the previous pages describe how some people will be able to communicate within the next fifteen years. We want to make sure that these communication opportunities are available to all people who want them, in their homes, and at reasonable prices. We expect that the transition from current technologies, services, and usage patterns to our “tomorrow” scenario will last well into the first decade of the 21st Century, but we believe that today’s events are shaping the course of that transition. Actions can be taken today that will help ensure that our “tomorrow” scenarios are not limited to the affluent.

The Alliance believes that it is now time to adopt a national goal: a universal *Broadband Telecommunications Platform*. By “broadband,” we mean a network that is capable of carrying multiple channels of switched interactive multi-media communications (voice, data, and video). In order to connect each individual to everyone else, and to diverse sources of information, entertainment and services, the network must have four physical characteristics in addition to its broad bandwidth:

- digital switching
- interoperability
- security and reliability
- usability

It must be available universally on a common carriage basis, and it must provide privacy and intellectual property protections. In this section, we describe these characteristics in more detail. Following that, we discuss policy and regulatory options.

A. Functional Features of the Broadband Platform

1. Universal Service

Probably the most important characteristic of the *Broadband Telecommunications Platform* is that it should be universally available to all citizens in their homes, public schools, and health care centers. The concept of “universal service,” first developed under the Communications Act of 1934, should no longer be limited to Plain Old Telephone Service, the term that’s used to describe voice telephony, but should be extended to new communication capabilities.

One of the important features of a *Broadband Telecommunications Platform* is that its benefits increase when more people are connected to it. Universality of service is more than an issue of equity; it also makes good economic sense. Imagine a telephone system that only connects customers to twenty or thirty homes or businesses: users would not be willing to pay much for that service. The value of the public telephone network lies in its ability to connect each user to millions of other people in the world, including many whom they

don't know. In the future, the value of integrated and interactive multi-media services will depend upon all citizens, businesses, and organizations having these capabilities.

Universality is especially important if our many public and private service agencies are to take maximum advantage of new information technologies. A motor vehicles department or local school system can justify the transition to electronic communication if each can reasonably expect to reach all their constituents. The *Broadband Telecommunications Platform* is a formula for stretching public dollars and creating more efficient services.

2. Common Carriage

As common carriers, telephone companies are obligated to make their service offerings available to any customer willing to pay the going rates; they are not allowed to discriminate. Common carriage has two important implications in an era of advanced telecommunications. On the one hand, owners and operators of the public switched network should continue to be obliged to serve all customers. On the other hand, network operators should also be obligated to make the platform available to any service provider. If society is to assure that the benefits of the Information Age are available to all citizens as customers and as service providers, then it is important to have a public network with a common carrier obligation.

3. Privacy and Intellectual Property Protections

As we take advantage of the efficiencies of centralized databases, remote searches, and new "publishing" opportunities, we need to be certain that the legal infrastructure is in place to protect privacy rights and sort out questions of ownership of electronic data and images. We need to raise society's level of sophistication about the implications of the Information Age in terms of our personal liberties and responsibilities.

B. Physical Characteristics of the Platform

1. Broadband

Bandwidth refers to the range of signal frequencies that can be carried by a communications channel. One way of characterizing this capacity is to measure the number of digital signals in bits per second that a conduit can carry. These are generally characterized as "narrowband" (less than 128 kilobits per second); "wideband" (up to about 45 million bits per second); "broadband" (over approximately 50 million bits per second).

Today, "broadband" is commonly used to mean the bandwidth necessary to carry one or more uncompressed television-quality video signals, although improvements in transmission and signal processing are constantly increasing the amount of information that can be sent through a given-size conduit. While it is possible that compression may enable a full motion video to be transmitted one-way over copper wire, we expect that the need for two-way visual high-bandwidth applications will increase. We believe that seeking a broadband

network now will be far more cost effective in the long run than operating on undocumented assumptions that narrowband communication will meet the foreseeable needs of the public.

This anticipated increase in demand for interactive video points to the implementation of fiber optic cable as a major component of a broadband network, with wireless and other wired technologies supplementing it. The cost of fiber has now dropped to the point where it is generally used for new construction. Along with the wireless technologies, its cost will continue to fall, so that widespread deployment of fiber optic cable will become economically feasible.

While the interexchange carriers' networks are almost one hundred percent fiber, the local telephone companies' fiber networks currently predominate in the trunk and feeder portion of the network. Local telephone companies are planning upgrades, however. Cable television companies are also investing in fiber, again mostly in the trunk and feeder portion of the network. While coaxial cable (which makes up most of cable companies' networks) is capable of carrying a full-motion video signal, almost all of these systems were designed as one-way services. Cable companies are currently experimenting with ways to upgrade their systems to provide limited interactive capabilities, such as "pay-per-view" video entertainment.

2. Digital Switching

Switched networks allow users to establish communications with other users when desired. Once established, these connections can be switched mechanically. Telephone operators used to frantically plug and unplug wires on a switchboard. Digital switches can now perform this task electronically, with more speed and accuracy.

Only digital switching is capable of handling data at the high-bandwidth rates that interactive full-screen video services would require. Almost all switches in the interexchange networks are already digital; the percentages of digital lines of the local telcos range from 37 percent to 86 percent.¹ High speed switches and their accompanying software are now coming on stream commercially. At the same time, laboratories are working to perfect "optical switching," a technology that operates directly on the digital light pulses that flow through fiber, rather than converting them to electronic signals first.

3. Interoperability

A third technical characteristic of the *Broadband Telecommunications Platform* is that it must be capable of handling messages from a variety of equipment and in a variety of formats. This is generally called "interoperability." With the explosion of competition in the telecommunications industry and the plethora of new telecommunications applications, we can expect that users will continue to deploy a wide variety of public and private networks. They will need to do this "transparently." The transparency of the plain old telephone network was a key to its usefulness—a caller could pick up the phone, dial a number, and ex-

Current Applications: Limited Multimedia and Broadband Experiments

The California Board of Education has adopted "Science 2000," an innovative, multi-media 7th grade science curriculum that relies on computer terminals and voice/data/video links instead of textbooks.

Bergen County, New Jersey has contracted for a fiber-based interactive network to connect its 44 secondary schools with two local community colleges by 1995; 14 schools and the two colleges are currently using the network.

GTE's Cerritos Project is a test-bed that provides video-on-demand and video teleconferencing to schools and residents in Cerritos, California. Users can choose from a library of videos and view them almost instantly in their homes or classrooms. They can also set up spontaneous full-motion video teleconferences with other users.

The Research in Advanced Communications in Europe's CAR project is working to develop an integrated broadband network to link automobile manufacturers, design teams, and parts suppliers. The network will support voice, video, and high-speed data communications.

The Interactive Cinema Group at MIT's Media Laboratory is developing an interactive digital movie system that would allow viewers to download videos to their home, request supplementary materials (reviews, information on the movie, etc.), and even customize the movie by choosing the desired degree of sex and violence and/or one of several endings to the movie.

In 1991, doctors in Boston used an experimental transmission system to relay high-definition images from Belize, South America in order to study patients suffering from a skin disease. The pictures were of such high-quality that the doctors could clearly see the changes in patients' skin as a result of the disease.

In 1992, doctors in Austin, Texas monitored dialysis patients at Giddings State Hospital, 65 miles away. They used a video camera to see and talk with their patients; they were even able to see the color of the toes of their diabetes patients, an indicator of physical well-being.

The nonprofit Hanover Foundation for Informed Medical Decision Making in New Hampshire has developed video programs to help patients choose treatment for four common ailments: benign prostate disease, low back pain, high blood pressure and early stage breast cancer. The interactive videos tell viewers about the risks and benefits of different treatments. Surgery rates fell sharply for patients with benign prostate enlargement who used these tapes.

Since 1991, members of a large HMO in Burlington, Massachusetts have had access to a health care information and consultative system via a terminal. The system enables them to get recommendations for steps to take with respect to specific symptoms that they are experiencing and also to get information about general health conditions of concern to them. In this way, they can communicate with their health care center and avoid "telephone tag" with doctors.

Martin Marietta has linked its Electronic Systems Division via a fiber optic broadband network, using voice, data and video communication to facilitate telecommuting for a portion of its off-site employees. The system allows workers to work from remote sites at least part of the week.

pect to talk to any person hooked up to the network without knowing just how the connection was made. This transparency will be much more difficult to achieve in today's multi-media, multi-vendor world. Yet the value of the platform will lie in the user's ability to connect with any other person without worrying about what kind of equipment, software, or network is being used.

4. Security and Reliability

As telecommunications services support more and more of our everyday activities, the security and reliability of the telecommunications infrastructure becomes essential. The *Broadband Telecommunications Platform* must incorporate adequate mechanisms for protecting users against theft, interception, or tampering with the electronic messages transmitted over the network. Developing plans for responding to emergencies that could affect the reliability and viability of the network will require a great deal of coordination among public and private network administrators and equipment manufacturers. It will be necessary to design networks that incorporate redundancy in order to protect the whole network from the failure of any of its parts.

5. Usability

The growing percentage of older Americans as a proportion of the population and the passage of the Americans with Disabilities Act has opened our eyes to the wide range of sensory, cognitive, and motor requirements of our citizens. We can no longer talk about "the handicapped" as if they were a small, definable portion of society with specific, highly-specialized needs. "They" are us—people who have difficulty seeing or hearing or remembering or walking. We now recognize that the problem is we can not get over the curb, whether it is because we are in a wheelchair or because we're pushing two children in a stroller.

The Alliance believes that the services of the *Broadband Telecommunications Platform* must be designed with all users in mind. Telephone systems already provide means for the hearing-impaired to use the telephone. Today, this is typically accomplished through an operator who types messages conveyed by the hearing party. Similarly, when text-based services are made available, service providers will have to make arrangements for them to be delivered audibly for the visually-impaired. Services which are designed to be accessible in several different ways from the outset offer a choice of interfaces for all customers, not just those with "disabilities." In this way, the public telecommunications network will become the electronic "curb cut" of the Information Age and will eliminate the need for a third party to translate or mediate difficult equipment.

It makes sense to us to think of "usability" is an evolutionary characteristic that should be continually updated to meet the needs of users by taking advantage of new technologies. The goal is to make communication—via voice, data, text, video, or multi-media—as easy and effortless as possible. The need for interoperability, discussed above, is relevant here. With protocol conversion and translation capabilities built into a central public resource, the

Broadband Telecommunications Platform will help make true “usability” a reality for all customers.

C. Transition to the Broadband Platform

APT believes that to offer everyone two-way voice, video, and data, the *Broadband Telecommunications Platform* must have digital switching capabilities and is likely to rely in large part on fiber optic cable. It is obvious that this optimal platform will not appear over night. However, without appropriate public policies, the transition will occur more slowly and will benefit only a limited number of people, primarily large businesses in urban areas. This would connect a few users to each other rather than each to all. In the following section, we discuss public policy that will ensure that we receive the greatest benefits from the *Broadband Telecommunications Platform*.

Making It Happen: Public Policy for the Broadband Telecommunications Network

APT believes in the efficiencies and benefits of competition. We also believe that regulation will be essential to ensure that competition and universal service are compatible goals. Competition is most beneficial when it takes place inside a framework that defines the *Broadband Telecommunications Platform* as the natural evolution of universal service. To achieve that goal will require amending the Communications Act of 1934 to extend its definition of universal service to all forms of communication: voice, data, image graphics, and full motion video.

A regulatory framework that promotes the *Broadband Telecommunications Platform* will have to differ from the present framework in another important way: it will have to *eliminate the differences among the various communications media*. Because universal service applied only to wired telephony in 1934, it was more strictly regulated than the broadcast medium, radio. When television became available commercially, it was treated like radio. Today, television, radio and cable TV remain lightly regulated. At the same time, print media is virtually unregulated.

In 1993, the differences among these communications media are more apparent than real. Newspapers are delivered by satellite (like a broadcast) to presses in remote cities. Like telephone, local access television signals are delivered entirely by microwave, satellites and wire. All these signals are or can be digital. For example, as high definition television (HDTV) becomes available, more and more video signals will be digital. Thus the distinctions among the media are outmoded. A regulatory framework for the 21st century will focus on ensuring public access to all kinds of services no matter what form they take. To accomplish this goal, it will be necessary to *look at the service being regulated*, rather than at the company or technology.

If the opportunities of interactive multi-media are available only to those who can build or rent private networks, then the value of the public network will decline as the innovative leaders divert their telecommunications dollars into private network investments. The public network will become a low-tech network of last resort. In contrast, if these innovators remain on the public network, they will demand services that will benefit all users, large and small. What is more, they will be willing to pay for these services even when they are new and relatively expensive, because they will be able to reap the benefits of them most quickly. This approach assists large users because it provides easy access, cuts costs and assures system compatibility.

Finally, upgrading the public telephone network to a *Broadband Telecommunications Platform* will help ensure the widespread use needed to encourage the growth of new information applications. If private networks cannot “talk to each other” and cannot reach users who are not on a private network, then the development of sophisticated information services will be slowed. Interoperability, a characteristic of a *public switched network*, can be achieved by developing standards and translation capabilities.

A regulatory framework to support development of the *Broadband Telecommunications Platform* must:

- assure universal service for two-way interactive video services
- assure interoperability of public and private networks
- safeguard privacy and intellectual property
- encourage planning for security and reliability
- promote fair competition
- promote affordable services
- break out of the current regulatory approach that distinguishes among providers based on old technologies
- encourage innovation in services and technologies
- establish guidelines for levels of performance and reliability

Developing this regulatory framework will take more than tinkering with the existing rules. It will require new thinking based on current technological advances. The overall goal will be to develop the *Broadband Telecommunications Platform* as the new form of universal service. A national task force on telecommunications policy would make an excellent forum for developing such a comprehensive view. But the task force must not delay in offering the results of its deliberations, as many decisions are now being made that could limit the actions open to policymakers.

Paying for the Broadband Telecommunications Platform

Some experts disagree about the financial viability of building a broadband network in the United States. However, the Alliance agrees with those experts who believe that the platform offers enough benefits to make it an attractive investment.² Among the benefits are:

- reduced cost of delivering health, education, and other government services
- improved quality of these same services
- improved access to jobs and job training for all Americans, especially the economically disadvantaged
- improved access to social and economic activities of all kinds for those with disabilities and those who cannot read or speak English well
- reduced pollution as people substitute the network for motor transport
- increased innovation in the kinds of information services that will be in great demand for world trade

These benefits are best realized through a shared public network. For example, it would be difficult to charge customers for the benefits of cleaner air from other telecommuters' reduced driving. Because they cannot charge for these kinds of desirable outcomes, network operators have less incentive to invest in a public network than is justified by the total social benefits. Public policy must be devised to provide such incentives. In return, network owners and operators must be obligated to provide low-cost access to the network for all.

Focusing on old figures and untenable assumptions about a fiber optic network, critics of the Alliance's position argue that consumers do not want or need advanced telecommunications services and should not have to pay for the investment in the network through higher rates for basic service. The critics estimate the cost to convert the present public switched network to fiber at \$3,100 per subscriber, a net present value of a little over \$40/month, assuming a ten-year payback at twelve percent.

We agree that this is an unreasonable cost if all consumers would have at the end is Plain Old Telephone Service provided by fiber instead of copper wire. We also agree that continued regulatory oversight is necessary to ensure that appropriately low rates are available for minimal usage. Universal service has always rested on subsidization; that is, using money to help out those who cannot pay full rates or those who live in places that are especially costly to serve. The need for subsidization will continue when universal service comprises advanced information services.

However, we think the critics err in two ways:

- 1) Their cost estimates are too high, and
- 2) They ignore the extraordinary benefits people will receive in return for higher rates.

The cost estimates are too high because they do not take into account the declining cost of technology. They also fail to consider that much of the investment in advanced infrastructure would have been made in any case. In effect, they count some of the investment twice.

More important, we do not agree that low volume users do not need or want these services. A quick look at our today/tomorrow scenarios and the list of applications now being tested will show that they benefit all citizens regardless of race, economic status, functional limitation or location, so long as they are easy to use and widely accessible. Public investment in the broadband network should be judged in the same way as all other investments: not on the basis of current costs but on the basis of the benefit-cost ratio; that is, whether

present and future benefits exceed current costs. We have shown that the benefits of a *Broadband Telecommunications Platform* are enormous and accrue to everyone -- businesses, individuals and the nation as a whole in the form of economic development and global competitiveness. With appropriate public oversight, these benefits can and should be available to everyone for affordable rates.

Conclusion

The Alliance for Public Technology is committed to the widest possible access to the most advanced telecommunications services at reasonable rates. These rates would be subsidized, if necessary, for people who cannot otherwise afford them or for regions where the cost of service would be unusually high. Rapid changes in technology have only confirmed our original premise: that every consumer in our nation could be connected to every other consumer in a way that allows easy exchange of voice, data, and video signals. The challenge we face lies in mobilizing public will to ensure that the *Broadband Telecommunications Platform* achieves its promise to carry the nation forward into the 21st Century with a strong economy and a strong people.

The next step is to engage in dialogue about the relative merits of this, and alternative, visions. APT's mission is to get the public involved in learning about telecommunications opportunities and participating in policy debates. We have initiated public debate, but we still need to invest in information and education campaigns. Our members, as representatives of various consumer interest groups, are in a good position to carry out such education. We hope that this paper will provoke debate and raise people's understanding of the opportunities telecommunications can offer, as well as the extensive planning and preparation that will be necessary to realize those opportunities.

We have presented a vision for the future of the public switched network that operates as a *Broadband Telecommunications Platform*, supporting interactive multi-media services to the nation's homes and businesses. We have also outlined some of the characteristics that we believe the network should have. We offer this vision for the consideration of telecommunications decisionmakers and other public interest groups like ourselves, so that future telecommunications policies will be made with the interests of all consumers in mind.

There is broad national agreement that the United States' position in the global economy in the 21st Century depends upon the creation of an advanced national telecommunications infrastructure. We want to make sure that this new infrastructure is both equitable and accessible for all of our country's citizens. *By connecting each to all*, we promote economic development, strengthen the individual and benefit all members of society.

Endnotes

- ¹ Ray Smith, "Cautious—Not Complacent," *Telephone Engineer and Management* 96(2), 1992, p. 36.
- ² See, for example, Anita Taff, "U.S. Fiber Network Could Be a Boon for Users," *Network World* 9(9), 1992, pp. 19-20 and Bruce Egan, *Information Superhighways: The Economics of Advanced Public Communication Networks*. Boston: Artech House, 1991, p. 118.

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